

DECEMBER, 2019

White Paper

Continuous Methane and VOC Monitoring During Pre-Production Operations

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The Colorado Bellwether



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New Colorado oil and gas regulations put into place in 2018 have far-reaching implications for the oil and gas industry in the state and have the potential to serve as a model for legislation in others. Senate Bill 181, or SB-181, decentralized rulemaking impacting the industry, effectively granting “local control” to county and municipal governments. This year local governments began the process of evaluating, adopting and implementing new regulations.

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A central focus of the process in several counties has been further restricting emissions from oil and gas development and production activities. Oil and gas operators in areas designated by the EPA as “Non-Attainment Areas” based

on levels of ozone and Volatile Organic Compounds (VOCs) are no strangers to managing emissions. The Front Range Non-Attainment Area in Colorado impacts the prolific DJ Basin. The San Antonio Non-Attainment Area impacts industry operations in the Eagle Ford Shale, and the Upper Green River Basin Ozone Nonattainment Designation Area affects the industry in the Green River Basin of Wyoming.

By implementing sealed storage tank hatches, vapor recovery units and increased Leak Detection and Repair (LDAR) teams, the industry has made significant reductions in emissions from producing well sites and multi-well production pads. But regulators are taking a new focus on pre-production activities, including drilling and completion operations.

Pre-Production Monitoring



Emissions of methane and VOCs during drilling and completion operations before wells are turned to production, or the pre-production phase, are coming under increased regulatory scrutiny. Regulators in several Colorado counties are poised to adopt new regulations that would require companies to continuously monitor fugitive emission levels at drill sites before the wells are completed and producing. The day is coming that operators will not be able to secure drilling or air permits without a continuous air quality monitoring system.

The current state of “monitoring” technology has, until now, been problematic in that existing solutions that claim to be “continuous” are often cost-prohibitive, unreliable and have a limited monitoring radius. The results can be inaccurate and generate data that is stale and not actionable.



Project Canary

Solution

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The Project Canary solution offers oil and gas operators a continuous, simple, rugged and affordable method to monitor for fugitive emissions during the pre-production phase and after wells have been turned over to production.



Continuous. Every few seconds, Canary sensors monitor, measure, record and report emissions, wind speed and direction, temperature, barometric pressure, and other relevant data, to the Canary Cloud.



Simple. Setup is as simple as staking unit sensors on the corners of the drill site perimeter. Self-locating technology automatically notifies the Canary Cloud they are active. Sensors are solar powered, meaning no external battery or grid power source is required (day or night). No personnel are required to be stationed on site.



Rugged. The all-weather sensor is simple, has no moving parts and requires no scheduled maintenance, typically making it the most reliable piece of equipment on the wellsite.



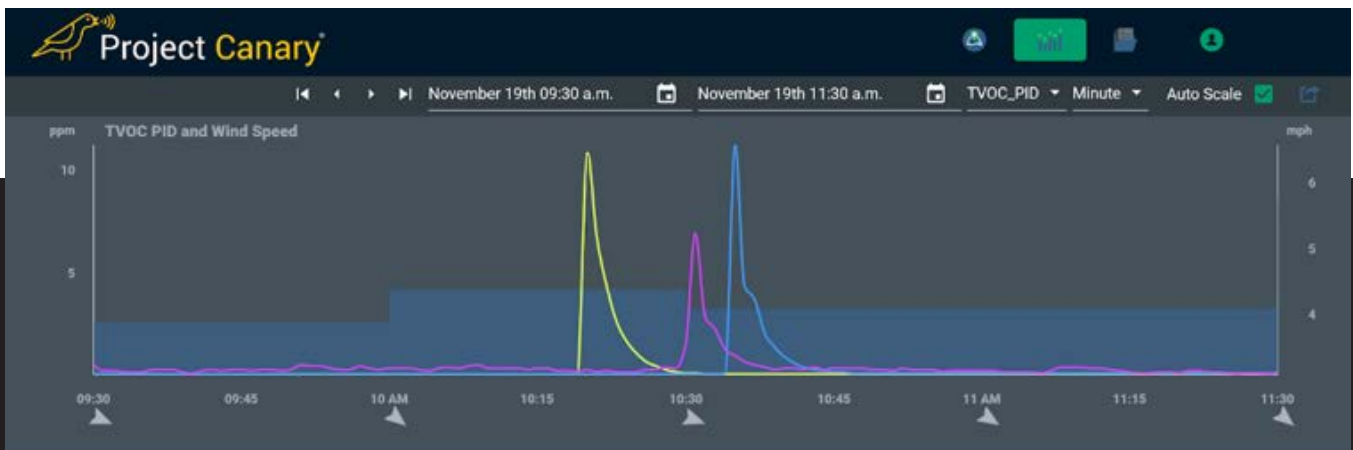
Affordable. The Project Canary solution is significantly less expensive than competing methods, including IR cameras, satellite, vans, aircraft or drones.

Project Canary Put to the Test

To get a better idea of where future air quality regulations could be headed, look north to Wyoming.

The Wyoming Department of Environmental Quality (DEQ) reports that in July 2012, the U.S. EPA designated all of Sublette county and portions of Lincoln and Sweetwater Counties as an ozone nonattainment area, collectively known as the Upper Green River Basin Ozone Nonattainment Designation Area (UGRB).” The Pinedale and Jonah natural gas fields are largely located in Sublette County, and are the focus of growing regulatory scrutiny.

In cooperation with the Wyoming DEQ, the Project Canary solution was put to the test in a live demonstration of the technology. Wyoming DEQ members watched live data roll in from small live propane releases. The graphic below illustrates the readings from the Canary S sensors in response to the release events. In each case, the sensors detected the propane emissions within a few minutes of the actual releases, providing near real-time, actionable data.



All Canary S units performed as expected, and DEQ reacted favorably to this live, high-stakes demonstration in which emissions data was recognized and reported within 60 seconds of the event. Additionally, DEQ personnel expressed satisfaction that the data was being collected and secured by a B-Corp with no conflicts of interest with the industry.



METEC - Evaluation Results

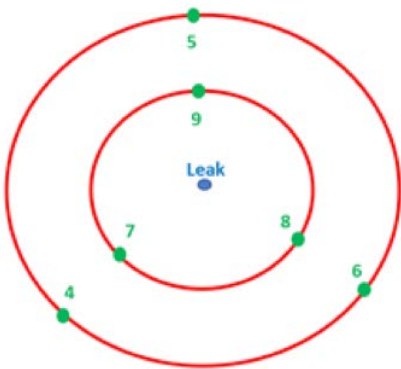
To our knowledge, the Project Canary solution is the only continuous fenceline monitoring system who has successfully detected emissions at the Methane Emissions Technology Evaluation Center (METEC), a collaboration between Colorado State University and industry.

In a controlled test at METEC, Canary S sensors encountered challenging environmental conditions. Snow, 30 MPH winds and volatile conditions made for a difficult monitoring environment. One METEC operator commented, "These are some of the hardest conditions we have seen anyone test in. We have very little scheduled for the next two months given the conditions."

The test was designed to validate Project Canary sensor readings, gain observed data on dispersion and distance effects and prove the ability to detect even small leaks. During the test, METEC operators

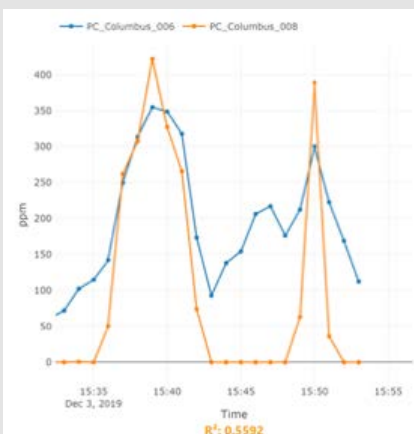
conducted a VOC leak consisting of 50% ethane & 50% propane as well as a methane leak. The test duration was limited to less than 60 minutes.

The graphic to the left illustrates the location of the Canary S sensors relative to the leak source.

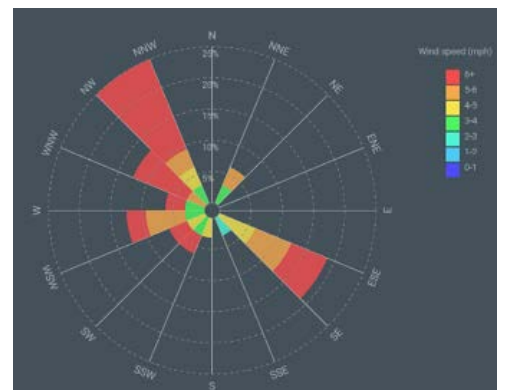
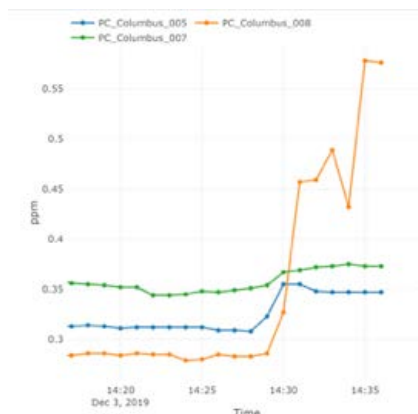


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The chart below demonstrates that the Project Canary sensors picked-up a methane leak within minutes of the event.



Additionally, the Canary S sensors were able to accurately identify an event amidst strong and rapidly shifting winds. The orange line is the VOC reading from the Number 8 sensor. As winds shifted and blew the plume towards the Number 8 sensor, it quickly picked-up and accurately reported VOC levels. Other units served as baseline metrics to suggest an abnormality.





Passing Scrutiny

In addition to the Wyoming DEQ and leading operators, other regulatory and influencer organizations are actively evaluating the Project Canary solution.



U.S. Environmental Protection Agency. Canary S technology from Lunar Outpost is on a recommended sensor provider list with the EPA. EPA uses sensors as a customer and is doing an entire study on sensors for possible wider deployment.



Eastern Research Group. A Canary S customer who does extensive work for EPA contracting and testing.



Colorado Department of Public Health and Environment (CDPHE). Current customer for wildfire detection. Particulate matter (PM) sensors tested in state smoke chamber alongside regulatory device with excellent results.



Air Quality Sensor Performance Evaluation (AQ-SPEC). QA/QC for PM IoT sensors based in Southern California. Testing is currently in progress.

That recognized leaders in environmental quality and regulatory experts are using and/or evaluating Project Canary technology speaks to both the rising importance of air quality regulations and potential for the solution to help industry meet or exceed restrictions.

The Value of Independence



Project Canary is an independent B-Corp with zero conflicts of interest. We do not work for operators. We simply provide them with data that everyone, including regulators and environmentalists, can trust.

Our independence is your benefit.

All the environmental data we collect is stored on the Canary information infrastructure, ensuring it is accurate, secure and unbiased. As a result, the data can be used to provide evidence of responsible operatorship and identify best practices to optimize operational efficiency.

Benefits

- Ability to secure drilling and/or air permits when continuous monitoring is required.
- No changes are required to existing drilling and completion processes and activities.
- More affordable than other, less reliable methods.
- Independent data when it is needed.
- Improved safety profile from remote monitoring.

